TCAS II CHANGE PROPOSAL (CP)

DATE: 05 / Sep / 07 **No.: CP115**

TCAS II Version: **DO-185A (v7)** X **Other (Specify)** _____

MOPS Function Area: **Surveillance** ____ **Display Req'ts** X **CRS** X

CAS Pseudocode X **Test Suites** X **Other** ____

Priority: **URGENT** X **Necessary** ____ **Optional** ____

CP Type: **ERROR** X **Enhancement** ____ **Evaluation Request** ____

Editorial (Logic) ____ **Editorial (Text)** ____

Description of Problem/Issue:

Unintentional opposite reactions to initial AVSA RAs have been identified. These opposite reactions have led to serious altitude busts and have significantly increased the risk of collision.

This risk is estimated to exceed the tolerable rate for catastrophic events caused by equipment-related hazards by a factor of 5.

Proposed Resolution:

The proposed solution consists in replacing the 4 AVSA RAs (i.e. VSL0, VSL500, VSL1000 and VSL2000) with a single "Level-Off" RA (VSL0), resulting in a simpler TCAS RA design. The associated aural annunciation, "Adjust Vertical Speed, Adjust", will be accordingly replaced by a "Level-Off, Level-Off" message. The end result of theses changes is a single RA associated with an aural annunciation explicitly conveying the required action to comply with this RA.

Requester: SIRE+ Project

Organization: EUROCONTROL

DISPOSITION OF CHANGE PROPOSAL (Per RWG):
DATE OF DISPOSITION 12 / 11 / 07

Rejected _____ **Deferred** _____ **[Review Date:** ____ / ____ / ____ **]**

Accepted x **Modified** _____ **Withdrawn** _____

DISPOSITION OF CHANGE:

On Hold _____ **Designing** _____ **Testing** _____ **Done** x **[Date:** 12 / 11 / 07 **]**

Final Approval of Changes:

Signature: Andy Zeitlin, RWG Chair
Date: 12 / 11 / 2007

References:

1. RTCA/SC-147, "Assessment and Recommendations on Visual Alerts and Aural Annunciations for TCAS II", 14 March 2006.

2. Safety Issue Rectification Extension (SIRE)+ Project, "CP115 (LOLO) Evaluation Report", EUROCONTROL ACAS Programme, SIRE+/WP5/40/D Version 1.0, 16 May 2007.

3. SRM Panel, "Safety Risk Management Document (SRMD) for Change to TCAS Negative RA Logic", Version 1.1, 21 November 2007.

4. Estes, Steven, "Results of First Line Supervisors' Evaluation of TCAS CP115", MITRE/CAASD, December 7, 2007.

Pseudocode Changes

High level Pseudocode **BEFORE**

```
PROCESS Set_up_global_flags;

    CLEAR global flags to be set up;
    REPEAT WHILE (more entries in Intruder Track File);
        IF (no RA is to be displayed)
            THEN IF (Mode C threat became non-altitude reporting during RA)
                        THEN IF (range rate shows intruder not diverging)
                                    THEN SET flag to suppress clear-of-conflict announcement;
                                CLEAR altitude lost flag;
                        ELSEIF (surveillance dropped track on threat during RA)
                                    THEN SET flag to suppress clear-of-conflict announcement;
            ELSE    PERFORM Crossing_flag_check; <RA is to be displayed>
                    IF (RA sense has been reversed and RA is positive Climb or Descend)
                        THEN indicate that announcement is needed;
                    CLEAR indication of reversal on current cycle;
                    IF (former threat has lost alt. reporting AND the range rate is diverging)
        THEN CLEAR altitude lost flag;
        IF (clear of conflict)
            THEN indicate that "clear of conflict" is to be announced;
        Select next Intruder Track File entry;
    ENDREPEAT;

    IF (a reversal is in effect for a multiaircraft encounter AND there is a positive
            climb or descend RA)
        THEN SET flag indicating that an RA reversal has been issued;
                CLEAR flag indicating that a reversal is in effect for a multiaircraft encounter;
    PERFORM Set_up_display_outputs;
    Set flags to indicate if RA is crossing or reversal;
    IF (any new threat OR any change from preventive to corrective
            OR increase rate RA has been issued OR any strengthening or weakening occurred
            OR dual negative RA converted to single negative)
        THEN SET aural alarm flag;

END Set_up_global_flags;
```

High level Pseudocode AFTER

```
PROCESS Set_up_global_flags;

    CLEAR global flags to be set up;
    REPEAT WHILE (more entries in Intruder Track File);
        IF (an RA is active against this intruder)
            THEN IF (previous advisory was corrective)
                        THEN IF (previous advisory was a VSL to 500, 1000 or 2000 fpm)
                                    THEN IF (advisory was Climb sense)
                                                THEN   update resolution advisory array to Don't Descend advisory;
                                         IF (advisory was Descend sense)
                                                THEN   update resolution advisory array to Don't Climb advisory;
                                         Select negative advisory;
                                         Set displayed model rate to 0;
                                         IF (advisory was Climb sense)
                                                THEN   save this advisory if strongest climb sense so far;
                                                       Set climb goal to 0;
                                         IF (advisory was Descend sense)
                                                THEN   save this advisory if strongest descend sense so far;
                                                       Set descend goal to 0;
                                         Set index to own advisory array to index of saved advisory;
        IF (no RA is to be displayed)
            THEN IF (Mode C threat became non-altitude reporting during RA)
                        THEN IF (range rate shows intruder not diverging)
                                    THEN SET flag to suppress clear-of-conflict announcement;
                                 CLEAR altitude lost flag;
                        ELSEIF (surveillance dropped track on threat during RA)
                                    THEN SET flag to suppress clear-of-conflict announcement;
            ELSE    PERFORM Crossing_flag_check; <RA is to be displayed>
                    IF (RA sense has been reversed and RA is positive Climb or Descend)
                        THEN indicate that announcement is needed;
                    CLEAR indication of reversal on current cycle;
                    IF (former threat has lost alt. reporting AND the range rate is diverging)
        THEN CLEAR altitude lost flag;
        IF (clear of conflict)
            THEN indicate that "clear of conflict" is to be announced;
        Select next Intruder Track File entry;
    ENDREPEAT;

    IF (a reversal is in effect for a multiaircraft encounter AND there is a positive
            climb or descend RA)
        THEN SET flag indicating that an RA reversal has been issued;
               CLEAR flag indicating that a reversal is in effect for a multiaircraft encounter;
    PERFORM Set_up_display_outputs;
    Set flags to indicate if RA is crossing or reversal;
    IF (any new threat OR any change from preventive to corrective
            OR increase rate RA has been issued OR any strengthening or weakening occurred
            OR dual negative RA converted to single negative)
        THEN SET aural alarm flag;

END Set_up_global_flags;
```

Low level Pseudocode **BEFORE**

```
PROCESS Set_up_global_flags;

    CLEAR G.ALARM, G.ANYCORCHANG, G.ANYCROSS, G.ALLCLEAR;
    CLEAR G.ANYREVERSE, ANYTRACKDROP, ANYALTLOST;
    REPEAT WHILE (more ITF entries);
        IF (G.RA(1-10) EQ $FALSE)
            THEN IF (ITF.ALTITUDE_LOST EQ $TRUE)
                        THEN IF (ITF.RD LE 0)
                                    THEN SET ANYALTLOST;
                                CLEAR ITF.ALTITUDE_LOST;
                        ELSE IF (ITF.DITF EQ $TRUE)
                                    THEN SET ANYTRACKDROP;
            ELSE PERFORM Crossing_flag_check;
                    IF (ITF.REVERSE EQ $TRUE AND G.RA(1 or 6) EQ $TRUE)
                        THEN SET G.ANYREVERSE;
                    CLEAR ITF.REVERSE;
                    IF (ITF.ALTITUDE_LOST EQ $TRUE AND ITF.RD GT 0)
                        THEN CLEAR ITF.ALTITUDE_LOST;
        IF (ITF.CLEAR_CONFLICT EQ $TRUE)
            THEN SET G.ALLCLEAR;
                    CLEAR ITF.CLEAR_CONFLICT;
        Select next ITF entry;
    ENDREPEAT;

    IF (G.MAC_REVERSE EQ $TRUE AND G.RA(1 or 6) EQ $TRUE)
        THEN SET G.ANYREVERSE;
                CLEAR G.MAC_REVERSE;
    PERFORM Set_up_display_outputs;
    CLEAR SUCCESS;
    REPEAT WHILE (more ITF entries AND SUCCESS EQ $FALSE);
        IF (ITF.INT_CROSS EQ $TRUE OR ITF.OWN_CROSS EQ $TRUE)
            THEN SET SUCCESS;
        Select next ITF entry;
    ENDREPEAT;
    IF (SUCCESS EQ $TRUE)
        THEN SET G.CROSSING_RA;
        ELSE CLEAR G.CROSSING_RA;
    IF (G.ANYREVERSE EQ $TRUE)
        THEN SET G.REVERSAL_RA;
    IF (G.ANYNEWTHR EQ $TRUE OR G.ANYPRECOR EQ $TRUE OR G.ANYCORCHANG EQ $TRUE
            OR (G.CLSTRONG NE 0 AND (G.CLSTRONG NE G.CLSTROLD OR
                                        (G.DESTRONG EQ 0 AND G.DESTROLD NE 0)))
            OR (G.DESTRONG NE 0 AND (G.DESTRONG NE G.DESTROLD OR
                                        (G.CLSTRONG EQ 0 AND G.CLSTROLD NE 0))))
        THEN SET G.ALARM;

END Set_up_global_flags;
```

Low level Pseudocode **AFTER**

```
PROCESS Set_up_global_flags;

    CLEAR G.ALARM, G.ANYCORCHANG, G.ANYCROSS, G.ALLCLEAR;
    CLEAR G.ANYREVERSE, ANYTRACKDROP, ANYALTLOST;
    REPEAT WHILE (more ITF entries);
        IF (ITF.TACODE EQ $RA AND ITF.TPTR NE $NULL)
            THEN IF (G.CORRECTIVE_CLM EQ $TRUE OR G.CORRECTIVE_DES EQ $TRUE)
                    THEN IF (ITF.TPTR->TF.PERMTENT(11) EQ $TRUE OR
                            ITF.TPTR->TF.PERMTENT(12) EQ $TRUE)
                        THEN IF (ITF.TPTR->TF.PERMTENT(7) EQ $FALSE)
                                THEN G.RA(2,3,4,5) = '1000';
                            IF (ITF.TPTR->TF.PERMTENT(7) EQ $TRUE)
                                THEN G.RA(7,8,9,10) = '1000';
                            ITF.TPTR->TF.PERMTENT(5,6,11,12) = '10','00';
                            G.ZDMODEL = 0;
                            IF (ITF.TPTR->TF.PERMTENT(7) EQ $FALSE)
                                THEN G.CLSTRONG = MAX(G.CLSTRONG,
                                        EVAL(ITF.TPTR->TF.PERMTENT));
                                    GOALCL = 0;
                                ELSE G.DESTRONG = MAX(G.DESTRONG,
                                        EVAL(ITF.TPTR->TF.PERMTENT));
                                    GOALDES = 0;
                            ITF.TPTR->TF.POOWRAR = RAMAP(ITF.TPTR->TF.PERMTENT);

        IF (G.RA(1-10) EQ $FALSE)
            THEN IF (ITF.ALTITUDE_LOST EQ $TRUE)
                    THEN IF (ITF.RD LE 0)
                            THEN SET ANYALTLOST;
                        CLEAR ITF.ALTITUDE_LOST;
                    ELSE IF (ITF.DITF EQ $TRUE)
                            THEN SET ANYTRACKDROP;
            ELSE PERFORM Crossing_flag_check;
                IF (ITF.REVERSE EQ $TRUE AND G.RA(1 or 6) EQ $TRUE)
                    THEN SET G.ANYREVERSE;
                CLEAR ITF.REVERSE;
                IF (ITF.ALTITUDE_LOST EQ $TRUE AND ITF.RD GT 0)
                    THEN CLEAR ITF.ALTITUDE_LOST;
        IF (ITF.CLEAR_CONFLICT EQ $TRUE)
            THEN SET G.ALLCLEAR;
                CLEAR ITF.CLEAR_CONFLICT;
        Select next ITF entry;
    ENDREPEAT;

    IF (G.MAC_REVERSE EQ $TRUE AND G.RA(1 or 6) EQ $TRUE)
        THEN SET G.ANYREVERSE;
            CLEAR G.MAC_REVERSE;
    PERFORM Set_up_display_outputs;
    CLEAR SUCCESS;
    REPEAT WHILE (more ITF entries AND SUCCESS EQ $FALSE);
        IF (ITF.INT_CROSS EQ $TRUE OR ITF.OWN_CROSS EQ $TRUE)
            THEN SET SUCCESS;
        Select next ITF entry;
    ENDREPEAT;
    IF (SUCCESS EQ $TRUE)
        THEN SET G.CROSSING_RA;
```

```
        ELSE CLEAR G.CROSSING_RA;
    IF (G.ANYREVERSE EQ $TRUE)
        THEN SET G.REVERSAL_RA;
    IF (G.ANYNEWTHR EQ $TRUE OR G.ANYPRECOR EQ $TRUE OR G.ANYCORCHANG EQ $TRUE
            OR (G.CLSTRONG NE 0 AND (G.CLSTRONG NE G.CLSTROLD OR
                                     (G.DESTRONG EQ 0 AND G.DESTROLD NE 0)))
            OR (G.DESTRONG NE 0 AND (G.DESTRONG NE G.DESTROLD OR
                                     (G.CLSTRONG EQ 0 AND G.CLSTROLD NE 0))))
        THEN SET G.ALARM;

END Set_up_global_flags;
```

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2.2.5.5 Display of Resolution Advisories

Note: Resolution advisories against all threats detected by own TCAS are combined for pilot display, such that the most demanding resolution advisory of those active is displayed for each sense (up/down).

The logic indicates whether a displayed advisory requires corrective action by the pilot, or merely warns against initiating an action that could lead to inadequate vertical separation.

All positive RAs (CLIMB, DESCEND, INCREASE CLIMB/DESCENT, MAINTAIN CLIMB/DESCENT) are displayed and announced as corrective RAs, with a green "fly-to" indication being shown on the RA display. Positive RAs are only permitted to weaken to negative (VSL 0 fpm) RAs (LIMIT CLIMB and LIMIT DESCENT to 0 fpm RAs) once adequate (ALIM) separation has been achieved. This logic behavior reflects the observed behavior of pilots who will generally cause own aircraft to level off rather than initiating a maneuver towards a threat even when the logic calculates that the maneuver is safe. In a similar fashion, initial negative (VSL) RAs (0, 500, 1000 and 2000 fpm) are not permitted to weaken at all.

The logic also permits TCAS to use on-board altitude alerter information solely for the purpose of making the resolution advisories more consistent with the aircraft's altitude clearance once the immediate collision threat has been resolved. This means that at the point when the logic normally would weaken the RA from positive to negative (VSL 0 fpm), the weakening would not take place if the positive RA would continue to direct own aircraft toward its clearance altitude. If own aircraft is nearing its cleared altitude before closest approach has been reached, the logic will weaken the RA to a corrective negative (VSL 0 fpm). ~~accompanied by the annunciation "Adjust Vertical Speed, Adjust.~~" In addition, corrective VSL 500, 1000 or 2000 fpm RAs that were issued prior to own aircraft approaching its altitude clearance would be strengthened to a corrective VSL 0 fpm RA ~~with the annunciation "Adjust Vertical Speed, Adjust"~~ to prompt own aircraft to level off at its cleared altitude. Of course, the conflict may be finished before the altitude clearance is reached in either encounter situation, in which case the RA will end and "Clear of Conflict" will be announced. The use of altitude alerter information is an implementation option.

In order to prevent operationally observed opposite pilot reactions to VSL 0, 500, 1000 or 2000 fpm RAs, the display unit replaces these RAs with a single level-off RA (VSL 0 fpm) accompanied by the annunciation "Level Off, Level Off."

Finally, TCAS will not display a Maintain Rate RA that calls for a vertical rate in excess of 4400 fpm. This is because the RA display on the Instantaneous Vertical Speed Indicator (IVSI) cannot place a green "fly-to" arc to accurately indicate such high rates. Instead, the logic will model own aircraft reducing its current vertical rate to 4400 fpm for the response to the Maintain Rate RA and select the sense that provides the best separation, even if it means that an RA will be chosen that is opposite to the current vertical direction.

Table 2-15 TCAS RA Aural Annunciations and Visual Alerts

RA	Aural Annunciation	Visual Alert[1]
Corrective Climb	Climb, Climb	CLIMB
Corrective Descend	Descend, Descend	DESCEND
Altitude Crossing Climb (Corrective)	Climb, Crossing Climb -- Climb, Crossing Climb	CROSSING CLIMB
Altitude Crossing Descend (Corrective)	Descend, Crossing Descend – Descend, Crossing Descend	CROSSING DESCEND
Corrective Reduce Climb	~~Adjust Vertical Speed, Adjust~~ Level off, Level Off	~~ADJUST V/S~~ LEVEL OFF
Corrective Reduce Descent	~~Adjust Vertical Speed, Adjust~~ Level off, Level Off	~~ADJUST V/S~~ LEVEL OFF
Reversal to a Climb (Corrective)	Climb, Climb NOW – Climb, Climb NOW	CLIMB NOW
Reversal to a Descend (Corrective)	Descend, Descend NOW -- Descend, Descend NOW	DESCEND NOW
Increase Climb (Corrective)	Increase Climb, Increase Climb	INCREASE CLIMB
Increase Descent (Corrective)	Increase Descent, Increase Descent	INCREASE DESCENT
Initial Preventive RAs	Monitor Vertical Speed	MONITOR V/S
Non-crossing, maintain rate RAs (Corrective)	Maintain Vertical Speed, Maintain	MAINTAIN V/S
Altitude crossing, maintain rate RAs (Corrective)	Maintain Vertical Speed, Crossing Maintain	MAINTAIN V/S CROSSING
Weakening of Corrective RAs	~~Adjust Vertical Speed, Adjust~~ Level off, Level Off	~~ADJUST V/S~~ LEVEL OFF
Clear of Conflict	Clear of Conflict	CLEAR OF CONFLICT

[1] The visual alerts shown in this column are applicable only to some display implementations.

Table 2-16: Mapping Between RA, Aural Annunciation, and ARINC Word 270 Contents

Advisory	RA Type	Aural Annunciation	Crossing_ Out[1]	Label 270 CONTENTS[2]											
				Rate to Maintain[3] (Bits 11-17) (fpm)	Combined Control			Vertical Control			Up Advisory			Down Advisory	
					18	19	20	21	22	23	24	25	26	27	28	29
Climb	Corrective	Climb, Climb	False	+1500	0	0	1	0	0	0	1	0	0	0	0	0
Descend	Corrective	Descend, Descend	False	-1500	1	0	1	0	0	0	0	0	0	1	0	0
Altitude Crossing Climb	Corrective	Climb, Crossing Climb -- Climb, Crossing Climb	True	+1500	0	0	1	1	0	0	1	0	0	0	0	0
Altitude Crossing Descend	Corrective	Descend, Crossing Descend -- Descend, Crossing Descend	True	-1500	1	0	1	1	0	0	0	0	0	1	0	0
Reduce Climb (Do Not Climb)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	1	0	1	0	0	0	0	0	0	0	1	0
~~Reduce Climb (Do Not Climb > 500 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~
~~Reduce Climb (Do Not Climb > 1000 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Reduce Climb (Do Not Climb > 2000 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~
Reduce Descent (Do Not Descend)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	0	0	1	0	0	0	0	1	0	0	0	0

Advisory	RA Type	Aural Annunciation	Crossing_ Out[1]	Label 270 CONTENTS[2]												
				Rate to Maintain[3] (Bits 11-17) (fpm)	Combined Control			Vertical Control			Up Advisory			Down Advisory		
					18	19	20	21	22	23	24	25	26	27	28	29
~~Reduce Descent (Do Not Descend > 500 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Reduce Descent (Do Not Descend > 1000 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~
~~Reduce Descent (Do Not Descend > 2000 fpm)~~	~~Corrective~~	~~Adjust Vertical Speed, Adjust~~	~~False~~		~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~
RA Reversal (Descend to Climb)	Corrective	Climb, Climb NOW -- Climb, Climb NOW	False	+1500	0	0	1	0	1	0	1	0	0	0	0	0
RA Reversal (Climb to Descend)	Corrective	Descend, Descend NOW -- Descend, Descend NOW	False	-1500	1	0	1	0	1	0	0	0	0	1	0	0
Increase Climb	Corrective	Increase Climb, Increase Climb	False	+2500	0	0	1	1	1	0	1	0	0	0	0	0
Increase Descent	Corrective	Increase Descent, Increase Descent	False	-2500	1	0	1	1	1	0	0	0	0	1	0	0
Maintain Rate RA (Maintain Climb Rate)	Corrective	Maintain Vertical Speed, Maintain	False	Existing V/S	0	0	1	0	0	1	1	0	0	0	0	0
Maintain Rate RA (Maintain Descent Rate)	Corrective	Maintain Vertical Speed, Maintain	False	Existing V/S	1	0	1	0	0	1	0	0	0	1	0	0

Advisory	RA Type	Aural Annunciation	Crossing_ Out[1]	Label 270 CONTENTS[2]												
				Rate to Maintain[3] (Bits 11-17) (fpm)	Combined Control			Vertical Control			Up Advisory			Down Advisory		
					18	19	20	21	22	23	24	25	26	27	28	29
Altitude Crossing Maintain Rate (Maintain Climb Rate)	Corrective	Maintain Vertical Speed, Crossing Maintain	True	Existing V/S	0	0	1	0	0	1	1	0	0	0	0	0
Altitude Crossing Maintain Rate (Maintain Descent Rate)	Corrective	Maintain Vertical Speed, Crossing Maintain	True	Existing V/S	1	0	1	0	0	1	0	0	0	1	0	0
Weakening of Positive RAs (After Up Sense RA)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	0	0	1	0	0	0	0	1	0	0	0	0
Weakening of Positive RAs (After Down Sense RA)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	1	0	1	0	0	0	0	0	0	0	1	0
Limit Climb (Do Not Climb)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	0	0	0	1	0
Limit Climb (Do Not Climb > 500 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	0	0	1	1	0
Limit Climb (Do Not Climb > 1000 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	0	0	0	0	1
Limit Climb (Do Not Climb > 2000 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	0	0	1	0	1
Limit Descent (Do Not Descend)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	1	0	0	0	0

Advisory	RA Type	Aural Annunciation	Crossing_ Out[1]	Label 270 CONTENTS[2]												
				Rate to Maintain[3] (Bits 11-17) (fpm)	Combined Control			Vertical Control			Up Advisory			Down Advisory		
					18	19	20	21	22	23	24	25	26	27	28	29
Limit Descent (Do Not Descend > 500 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	1	1	0	0	0	0
Limit Descent (Do Not Descend > 1000 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	0	0	1	0	0	0
Limit Descent (Do Not Descend > 2000 fpm)	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0	1	0	1	0	0	0
Multi-Aircraft Encounter[4,7] (Maintain Existing V/S)	Preventive	Maintain Vertical Speed, Maintain	See Note 7		0	1	1	0	0	1	0	1	0	0	1	0
Multi-Aircraft Encounter[5] (Issued While Climbing)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	1	0	1	0	0	0	0	1	0	0	1	0
Multi-Aircraft Encounter[5] (Issued While Descending)	Corrective	~~Adjust Vertical Speed, Adjust~~ Level-off, Level-off	False	0	0	0	1	0	0	0	0	1	0	0	1	0
Multi-Aircraft Encounter[6]	Preventive	Monitor Vertical Speed	False		0	1	1	0	0	0						
Clear of Conflict		Clear of Conflict	False		1	0	0	0	0	0	0	0	0	0	0	0

Table 2-66 RA Tests for Implementations Using Pitch Cues on a PFD

Advisory	RA Success Criteria
Climb	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "CLIMB" is written in red on the PFD. This visual alert flashes or is otherwise highlighted.
Descend	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "DESCEND" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Altitude Crossing Climb	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "CROSSING CLIMB" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Altitude Crossing Descend	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "CROSSING DESCEND" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Reduce Climb (Do Not Climb)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "LEVEL OFF~~ADJUST V/S~~" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
~~Reduce Climb (Do Not Climb>500 fpm)~~	~~A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~
~~Reduce Climb (Do Not Climb>1000 fpm)~~	~~A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,000 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~

Advisory	RA Success Criteria
~~Reduce Climb (Do Not Climb>2000 fpm)~~	~~A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 2,000 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~
Reduce Descent (Do Not Descend)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "LEVEL OFF~~ADJUST V/S~~" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
~~Reduce Descent (Do Not Descend>500 fpm)~~	~~A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~
~~Reduce Descent (Do Not Descend > 1000 fpm)~~	~~A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,000 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~
~~Reduce Descent (Do Not Descend >2000 fpm)~~	~~A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 2,000 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "ADJUST V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.~~
RA Reversal (Descend to Climb)	A red trapezoid is initially displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "DESCEND" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted. When the RA reverses to a Climb RA, the red trapezoid begins at the bottom of the PFD and extends upwards to the pitch angle required to obtain a 1,500 fpm rate of climb. If the implementation includes visual alerts on the PFD, "CLIMB NOW" is written in red on the PFD after the RA reverses. This visual alert either flashes or is otherwise highlighted.

Advisory	RA Success Criteria
RA Reversal (Climb to Descend)	A red trapezoid is initially displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "CLIMB" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted. When the RA reverses to a Descend RA, the red trapezoid begins at the top of the PFD and extends downwards to the pitch angle required to obtain a 1,500 fpm rate of descent. If the implementation includes visual alerts on the PFD, "DESCEND NOW" is written in red on the PFD after the RA reverses. This visual alert either flashes or is otherwise highlighted.
Increase Climb	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 2,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "INCREASE CLIMB" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Increase Descent	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 2,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "INCREASE DESCENT" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Maintain Rate RA (Maintain Climb Rate of 4000 fpm)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 4,000 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MAINTAIN V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Maintain Rate RA (Maintain Descent Rate of 4000 fpm)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 4,000 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MAINTAIN V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Altitude Crossing Maintain Rate (Maintain Climb Rate of 3200 fpm)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 3,200 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MAINTAIN V/S CROSSING" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.

Advisory	RA Success Criteria
Altitude Crossing Maintain Rate (Maintain Descent Rate of 2600)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 2,600 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MAINTAIN V/S CROSSING" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Weakening of Positive RAs (Climb RA Weakens to a VSL 0 RA)	A red trapezoid is initially displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "CLIMB" is written in red on the PFD. This visual alert flashes or is otherwise highlighted. When the RA weakens, the red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "LEVEL OFF~~ADJUST V/S~~" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Weakening of Positive RAs (Descend RA Weakens to a VSL 0)	A red trapezoid is initially displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "DESCEND" is written in red on the PFD. This visual alert flashes or is otherwise highlighted. When the RA weakens, the red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "LEVEL OFF~~ADJUST V/S~~" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Climb (Do Not Climb)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Climb (Do Not Climb > 500 fpm)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 500 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.

Advisory	RA Success Criteria
Preventive Limit Climb (Do Not Climb > 1000 fpm)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 1,000 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Climb (Do Not Climb > 2000 fpm)	A red trapezoid is displayed, beginning at the top of the PFD and extending downwards to the pitch angle required to obtain a 2,000 fpm rate of climb. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Descent (Do Not Descend)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain level flight. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Descent (Do Not Descend > 500 fpm)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 500 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Descent (Do Not Descend > 1000 fpm)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 1,000 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Preventive Limit Descent (Do Not Descend > 2000 fpm)	A red trapezoid is displayed, beginning at the bottom of the PFD and extending upwards to the pitch angle required to obtain a 2,000 fpm rate of descent. The trapezoid does not occlude any other information shown on the PFD. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Multi-Aircraft Encounter (Maintain Existing V/S)	A red trapezoid is displayed beginning at the top of the PFD and extending downwards to the pitch angle representing a 250 fpm rate of climb. A second red trapezoid is also displayed beginning at the bottom of the PFD and extending upwards to the pitch angle representing a 250 fpm rate of descent. There is sufficient room between the closed ends of the two trapezoids for the own aircraft reference symbol of the PFD to be displayed. If the implementation includes visual alerts on the PFD, "MAINTAIN V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.

Advisory	RA Success Criteria
Multi-Aircraft Encounter (Second Intruder Becomes a Threat While Responding to an Initial Climb RA)	A red trapezoid is displayed beginning at the bottom of the PFD and extending upwards to the pitch angle representing a 1,500 fpm rate of climb. If the implementation includes visual alerts on the PFD, "CLIMB" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted. When the second intruder becomes a threat, the trapezoid for the initial RA begins at the bottom of the PFD and extends upwards to the pitch angle representing a 250 fpm rate of descent. A second red trapezoid is also displayed beginning at the top of the PFD and extending downwards to the pitch angle representing a 250 fpm rate of climb. There is sufficient room between the closed ends of the two trapezoids for the own aircraft reference symbol of the PFD to be displayed. If the implementation includes visual alerts on the PFD, "LEVEL OFF~~ADJUST V/S~~" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.
Multi-Aircraft Encounter (Preventive RA Limiting Climb and Descent Rate to ±1,000 fpm)	A red trapezoid is displayed beginning at the top of the PFD and extending downwards to the pitch angle representing a 1,000 fpm rate of climb. A second red trapezoid is also displayed beginning at the bottom of the PFD and extending upwards to the pitch angle representing a 1,000 fpm rate of descent. There is sufficient room between the closed ends of the two trapezoids for the own aircraft reference symbol of the PFD to be displayed. If the implementation includes visual alerts on the PFD, "MONITOR V/S" is written in red on the PFD. This visual alert either flashes or is otherwise highlighted.

2. DO-185B Volume II

2.1.11.1.1.1.1 Climb_VSL

…

Transition(s): © → VSL0

Location: Composite_RA$_{s\text{-}106}$ ▷ RA$_{s\text{-}111}$ ▷ Negative$_{s\text{-}112}$ ▷ Climb_VSL$_{s\text{-}113}$

Trigger Event: N/A

Condition:

					OR		
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Climb$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL0	T	·	F	F	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Climb$_{s\text{-}229}$ ▷ Positive	·	T	F	F	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Climb$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL500	·	·	T	F	F
AND	**Some** Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Climb$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL1000	·	·	·	T	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Climb$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL2000	·	·	·	·	T
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≤ −500 ft/min$_{(V500)}$	·	·	T	·	·
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≤ −1000 ft/min$_{(V1000)}$	·	·	·	T	·
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≤ −2000 ft/min$_{(V2000)}$	·	·	·	·	T

Output Action: Composite_RA_Evaluated_Event$_{e\text{-}C2}$

Notes: *1.* ***Description:*** *Transition to VSL0 (the strongest negative VSL advisory) occurs when (1) a descend limit of 0 ft/min is required to achieve adequate separation for another aircraft, or (2) when a positive climb advisory is in effect against another aircraft, or (3) when a corrective non-zero rate climb sense VSL has been recommended for another aircraft.*

2. ***Pseudocode Reference:*** *ROUTINE RESOLUTION_UPDATE, Set_up_global_flags.*

2.1.11.1.1.1.2 Descend_VSL

…

Transition(s): © → VSL0

Location: Composite_RA$_{s\text{-}106}$ ▷ RA$_{s\text{-}111}$ ▷ Negative$_{s\text{-}112}$ ▷ Descend_VSL$_{s\text{-}118}$

Trigger Event: N/A

Condition:

				OR		
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Descend$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL0	T	·	F	F	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Descend$_{s\text{-}229}$ ▷ Positive	·	T	F	F	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Descend$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL500	·	·	T	F	F
AND	**Some** Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Descend$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL1000	·	·	·	T	F
	Some Other_Aircraft$_{s\text{-}157}$ **in state** Sense$_{s\text{-}221}$ ▷ Descend$_{s\text{-}229}$ ▷ Negative$_{s\text{-}112}$ ▷ VSL2000	·	·	·	·	T
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≥ 500 ft/min$_{(V500)}$	·	·	T	·	·
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≥ 1000 ft/min$_{(V1000)}$	·	·	·	T	·
	Own_Tracked_Alt_Rate$_{f\text{-}566}$ ≥ 2000 ft/min$_{(V2000)}$	·	·	·	·	T

Output Action: Composite_RA_Evaluated_Event$_{e\text{-}C2}$

Notes: *1.* ***Description:*** *Transition to VSL0 (the strongest negative VSL advisory) occurs when (1) a climb limit of 0 ft/min is required to achieve adequate separation for another aircraft, or (2) when a descend climb advisory is in effect against another aircraft, or (3) when a corrective non-zero rate descend sense VSL has been recommended for another aircraft.*

2. ***Pseudocode Reference:*** *ROUTINE RESOLUTION_UPDATE, Set_up_global_flags.*

2.2.4.1.2.1.5.1.2 Strength

…

Transition(s): VSL_500fpm → VSL_0fpm

Location: $\text{Threat}_{\text{s-207}} \triangleright \text{Strength}_{\text{s-232}}$

Trigger Event: $\text{Composite\_RA\_Evaluated\_Event}_{\text{e-C2}}$

Condition:

			OR
	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Descend\_VSL}_{\text{s-118}}$ **in state** VSL0	T	·
AND	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Climb\_VSL}_{\text{s-113}}$ **in state** VSL0	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \leq -500$ ft/min$_{\text{(V500)}}$	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \geq 500$ ft/min$_{\text{(V500)}}$	T	·

Output Action: None

Notes: ***1. Description:*** *The composite RA for ownship will always strengthen a corrective non-zero rate VSL advisory to a zero rate VSL advisory. When this happens, the RA strength against the threat aircraft should be updated accordingly.*

2. Pseudocode Reference: *Set_up_global_flags.*

2.2.4.1.2.1.5.1.2 Strength

…

Transition(s): VSL_1000fpm → VSL_0fpm

Location: $\text{Threat}_{\text{s-207}} \triangleright \text{Strength}_{\text{s-232}}$

Trigger Event: $\text{Composite\_RA\_Evaluated\_Event}_{\text{e-C2}}$

Condition:

			OR
	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Descend\_VSL}_{\text{s-118}}$ **in state** VSL0	T	·
AND	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Climb\_VSL}_{\text{s-113}}$ **in state** VSL0	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \leq -1000$ ft/min$_{\text{(V1000)}}$	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \geq 1000$ ft/min$_{\text{(V1000)}}$	T	·

Output Action: None

Notes: ***1. Description:*** *The composite RA for ownship will always strengthen a corrective non-zero rate VSL advisory to a zero rate VSL advisory. When this happens, the RA strength against the threat aircraft should be updated accordingly.*

2. Pseudocode Reference: *Set_up_global_flags.*

2.2.4.1.2.1.5.1.2 Strength

…

Transition(s): VSL_2000fpm → VSL_0fpm

Location: $\text{Threat}_{\text{s-207}} \triangleright \text{Strength}_{\text{s-232}}$

Trigger Event: $\text{Composite\_RA\_Evaluated\_Event}_{\text{e-C2}}$

Condition:

			OR
	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Descend\_VSL}_{\text{s-118}}$ **in state** VSL0	T	·
AND	$\text{Composite\_RA}_{\text{s-106}} \triangleright \text{Climb\_VSL}_{\text{s-113}}$ **in state** VSL0	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \leq -2000 \text{ ft/min}_{(\text{V2000})}$	·	T
	$\text{Own\_Tracked\_Alt\_Rate}_{\text{f-566}} \geq 2000 \text{ ft/min}_{(\text{V2000})}$	T	·

Output Action: None

Notes: *1.* ***Description:*** *The composite RA for ownship will always strengthen a corrective non-zero rate VSL advisory to a zero rate VSL advisory. When this happens, the RA strength against the threat aircraft should be updated accordingly.*

2. ***Pseudocode Reference:*** *Set_up_global_flags.*

3. DO-185B Test Suite

No new test cases are required for CP115 because the existing test cases cover all the logic changes introduced by CP115. The outputs of the following DO-185A test cases are modified by CP115:

1. EN02TS09
2. EN02TS39
3. EN03TS20
4. EN03TS30
5. EN03TS41
6. EN03TS51
7. EN03TS71
8. EN04TS17
9. EN04TS34
10. EN06TS23
11. EN06TS35
12. EN06TS53
13. EN06TS55
14. EN07TS09
15. EN09TS03
16. EN09TS04